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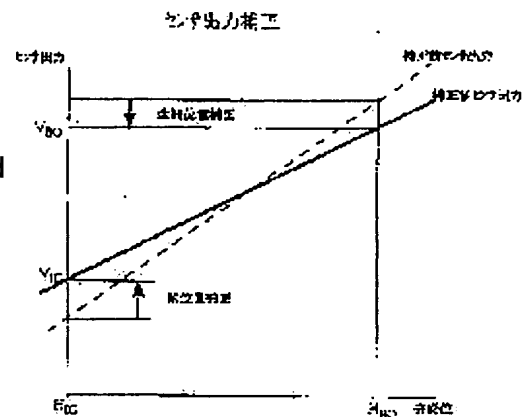
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## (54) SOLENOID VALVE SYSTEM CONTROL DEVICE OF ENGINE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To secure detecting accuracy of a position sensor for detecting an armature position used to control a solenoid valve system (intake-exhaust valves) of an engine.

**SOLUTION:** Before starting, initialization is performed for holding the intake valve in a closing position HIC (or a fully opening position) and the exhaust valve in a fully opening position HEO (or a closing position) to correct the relationship between an output value of the position sensor and a detecting value of the armature position on the basis of an output value VIC in the intake valve closing position of the position sensor for detecting the armature position corresponding to the intake valve and an output value VEO in the exhaust valve fully opening position of the position sensor for detecting the armature position corresponding to the exhaust valve.



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CLAIMS

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[Claim(s)]

[Claim 1] The spring which energizes an intake/exhaust valve in a half-opening location, and the electromagnet for valve opening which attracts an intake/exhaust valve in the valve-opening direction, and is held to an open position, The electromagnet for clausiliums which adsorbs in the direction of clausilium and holds an intake/exhaust valve to a closed position, After initializing before a preparation and engine start up by making an intake/exhaust valve hold to an open position or a closed position, In a valve train control unit the electromagnetism of the engine which carries out energization control of this each electromagnet, detecting the location of an armature common to said each electromagnet by the position sensor -- It is based on two output values corresponding to the open position and closed position after initialization of this intake/exhaust valve in the position sensor prepared in the intake/exhaust valve which changed the closing motion location after said initialization mutually. the electromagnetism of the engine characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location -- a valve train control unit.

[Claim 2] the electromagnetism of the engine according to claim 1 characterized by changing the closing motion location after said initialization of an inlet valve, and the closing motion location after said initialization of an exhaust valve, and amending the relation between the output value of a position sensor, and the detection value of an armature location based on two output values of the position sensor after these initialization -- a valve train control unit.

[Claim 3] the electromagnetism of the engine according to claim 1 characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location based on two output values of the position sensor after initialization of the inlet valves which changed the closing motion location after said initialization, or exhaust valves between cylinders -- a valve train control unit.

[Claim 4] The spring which energizes an intake/exhaust valve in a half-opening location, and the electromagnet for valve opening which attracts an intake/exhaust valve in the valve-opening direction, and is held to an open position, The electromagnet for clausiliums which adsorbs in the direction of clausilium and holds an intake/exhaust valve to a closed position, After initializing before a preparation and engine start up by making an intake/exhaust valve hold to an open position or a closed position, In a valve train control unit the electromagnetism of the engine which carries out energization control of this each electromagnet, detecting the location of an armature common to said each electromagnet by the position sensor -- It is based on the output value corresponding to the open position or closed position after initialization of the output value corresponding to the half-opening location before initialization of the intake/exhaust valve in said position sensor, and this intake/exhaust valve. the electromagnetism of the engine characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location -- a valve train control unit.

[Claim 5] The spring which energizes an intake/exhaust valve in a half-opening location, and the electromagnet for valve opening which attracts an intake/exhaust valve in the valve-opening direction, and is held to an open position, The electromagnet for clausiliums which adsorbs in the direction of clausilium and holds an intake/exhaust valve to a closed position, After initializing before a preparation and engine start up by making an intake/exhaust valve hold to an open position

or a closed position, In a valve train control unit the electromagnetism of the engine which carries out energization control of this each electromagnet, detecting the location of an armature common to said each electromagnet by the position sensor -- An intake/exhaust valve is temporarily held in a different closing motion location from the closing motion location after said initialization at the time of an engine operation halt. Memorize the output value of the position sensor in the held this closing motion location, and it is based on said memorized output value of this position sensor, and the output value in the intake/exhaust valve closing motion location after said initialization. the electromagnetism of the engine characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location -- a valve train control unit.

[Claim 6] the electromagnetism of the engine according to claim 5 characterized by amending the relation between the output value of said position sensor, and the detection value of an armature location after detecting the temperature condition of said position-sensor circumference and amending the output value of a position sensor according to a temperature gradient with the time of said engine operation halt and start up -- a valve train control unit.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] the engine electromagnetism which performs initialization which holds the intake/exhaust valve with which this invention is energized by the half-opening location with a spring to an open position or a closed position before start up -- it is related with amendment about a valve train control device at the time of start up of the sensor which detects especially the location of the armature of an electromagnet.

[0002]

[Description of the Prior Art] this kind of electromagnetism -- valve element (intake/exhaust valve) supported as a moving valve mechanism by the energization force by the spring of a couple in a half-opening location Electromagnetic force is made to act on the armature coordinated with this valve element, it is the structure moved in full admission or the close direction from said half-opening location, and initialization held to an open position or a closed position before start up is performed. Then, stop energization of the electromagnet for clausiliums at the time of valve opening, and it moves a valve element in the valve-opening direction by the energization force of a spring. This electromagnet for valve opening is energized from the place which approached the electromagnet for valve opening enough, and adsorption maintenance is carried out at an open position. At the time of clausilium Energization of the electromagnet for valve opening is stopped, a valve element is moved in the direction of clausilium by the energization force of a spring, this electromagnet for clausiliums is energized from the place which approached the electromagnet for clausiliums enough, and closing motion control which carries out adsorption maintenance is performed to the closed position.

[0003] By the way, a position sensor detecting the location of the armature of an electromagnet, feedback control of the energization control of said electromagnet for valve opening and the electromagnet for clausiliums is carried out, and it is performed so that the target rate for every location may be attained. It is necessary to carry out this energization control to high degree of accuracy so that the rate at the time of taking a seat of an armature or a valve element may be made sufficiently small, and an impact may be eased and responsibility may also be secured, and it is necessary to secure the detection precision of the armature location by said position sensor for that purpose.

[0004] however, electromagnetism -- since an armature location carries out aging by wear of each part of a valve train etc., the detection precision of an armature location will fall. that by which this invention was made paying attention to such a conventional technical problem -- it is -- engine electromagnetism -- amending appropriately the detection value of the position sensor which detects the location of the armature of an electromagnet in a valve train control device -- an armature location -- always -- high degree of accuracy -- detectable -- with -- \*\*\*\* -- it aims at enabling it to perform closing motion control of a highly precise intake/exhaust valve.

[0005]

[Means for Solving the Problem] For this reason, the spring with which invention concerning claim 1 energizes an intake/exhaust valve in a half-opening location, The electromagnet for valve opening which attracts an intake/exhaust valve in the valve-opening direction, and is held to an open position, The electromagnet for clausiliums which adsorbs in the direction of clausilium and holds an intake/exhaust valve to a closed position, After initializing before a preparation and engine start up

by making an intake/exhaust valve hold to an open position or a closed position, In a valve train control unit the electromagnetism of the engine which carries out energization control of this each electromagnet, detecting the location of an armature common to said each electromagnet by the position sensor -- Based on two output values corresponding to the open position and closed position after initialization of this intake/exhaust valve in the position sensor prepared in the intake/exhaust valve which changed the closing motion location after said initialization mutually, it is characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location.

[0006] According to invention concerning claim 1, two output values corresponding to the open position and closed position after initialization of this intake/exhaust valve are acquired by the position sensor prepared in the intake/exhaust valve which changed the closing motion location after initialization mutually, respectively. this -- since two output values correspond to the ends location of the armature in the open position and closed position of an intake/exhaust valve, respectively, they amend the relation between the output value of a position sensor, and the detection value of an armature location based on these two output values.

[0007] thus, if it carries out, since amendment of a position sensor will be performed for every time of start up, the detection precision of an armature location raises -- having -- with -- \*\*\*\* -- the closing motion control precision of an intake/exhaust valve is raised. Moreover, invention concerning claim 2 changes the closing motion location after said initialization of an inlet valve, and the closing motion location after said initialization of an exhaust valve, and is characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location based on two output values of the position sensor after these initialization.

[0008] Since according to invention concerning claim 2 it is usually set up for cranking after initialization so that it may differ from the closing motion location of an inlet valve and the closing motion location of an exhaust valve after initialization, based on two output values of the position sensor corresponding to the closing motion location of the inlet valve after this initialization, and the closing motion location of an exhaust valve, the relation between the output value of a position sensor and the detection value of an armature location is amended.

[0009] If it does in this way, based on the output value of the position sensor detected as it is, it can amend most simply by setting out of the usual initialization. Moreover, invention concerning claim 3 is characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location based on two output values of the position sensor after initialization of the inlet valves which changed the closing motion location after said initialization, or exhaust valves between cylinders.

[0010] According to invention concerning claim 3, although it is a different valve, since amendment is performed based on the output value of the position sensor to the valve of congener (inlet valves or exhaust valves), the precision of amendment improves.

[0011] Moreover, the spring with which invention concerning claim 4 energizes an intake/exhaust valve in a half-opening location, The electromagnet for valve opening which attracts an intake/exhaust valve in the valve-opening direction, and is held to an open position, The electromagnet for clausiliums which adsorbs in the direction of clausilium and holds an intake/exhaust valve to a closed position, After initializing before a preparation and engine start up by making an intake/exhaust valve hold to an open position or a closed position, In a valve train control unit the electromagnetism of the engine which carries out energization control of this each electromagnet, detecting the location of an armature common to said each electromagnet by the position sensor -- Based on the output value corresponding to the open position or closed position after initialization of the output value corresponding to the half-opening location before initialization of the intake/exhaust valve in said position sensor, and this intake/exhaust valve, it is characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location.

[0012] since the output value corresponding to the open position or closed position after initialization of the output value corresponding to the half-opening location before initialization of an intake/exhaust valve and this intake/exhaust valve is acquired by the position sensor according to invention concerning claim 4 -- this -- based on two output values, the relation between the output

value of a position sensor and the detection value of an armature location is amended.

[0013] If it does in this way, it can amend simply using the output value of the position sensor in setting out of the usual initialization, and detection precision will improve by using two output values of the same location sensor in the same valve.

[0014] Moreover, the spring with which invention concerning claim 5 energizes an intake/exhaust valve in a half-opening location, The electromagnet for valve opening which attracts an intake/exhaust valve in the valve-opening direction, and is held to an open position, The electromagnet for clausiliums which adsorbs in the direction of clausilium and holds an intake/exhaust valve to a closed position, After initializing before a preparation and engine start up by making an intake/exhaust valve hold to an open position or a closed position, In a valve train control unit the electromagnetism of the engine which carries out energization control of this each electromagnet, detecting the location of an armature common to said each electromagnet by the position sensor -- An intake/exhaust valve is temporarily held in a different closing motion location from the closing motion location after said initialization at the time of an engine operation halt. The output value of the position sensor in the held this closing motion location is memorized, and it is characterized by amending the relation between the output value of a position sensor, and the detection value of an armature location based on said memorized output value of this position sensor, and the output value in the intake/exhaust valve closing motion location after said initialization.

[0015] since the output value corresponding to the closing motion location after initialization of the intake/exhaust valve which differs from the output value and this closing motion location corresponding to the closing motion location of an intake/exhaust valve at the time of an engine operation halt by the position sensor is acquired according to invention concerning claim 5 -- this -- based on two output values, the relation between the output value of a position sensor and the detection value of an armature location is amended.

[0016] If it does in this way, a highly precise location sensor can be amended by using the output value corresponding to the open position of the same valve, and the output value corresponding to a closed position.

[0017] Moreover, invention concerning claim 6 is characterized by amending the relation between the output value of said position sensor, and the detection value of an armature location, after detecting the temperature condition of said position-sensor circumference and amending the output value of a position sensor according to a temperature gradient with the time of said engine operation halt and start up.

[0018] According to invention concerning claim 6, if it does in this way, a still highly precise location sensor can be amended by amending the relation between the output value of a location sensor, and the detection value of an armature location, after performing output-value amendment of a temperature gradient.

[0019]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on drawing. The engine 1 is equipped with the inlet valve 3 and exhaust valve 4 by which electronics control is carried out in closing motion with the valve driving gear 2 in drawing 1 which shows the system configuration of 1 operation gestalt of this invention. The inlet port 5 of each cylinder is equipped with a fuel injection valve 6, and the combustion chamber 7 is equipped with the ignition plug 8 and the ignition coil 9. Moreover, while outputting a reference signal to an engine by the criteria crank angle of each cylinder, it is equipped with the crank angle sensor 10 which outputs a unit angle signal for every minute crank angle, and the coolant temperature sensor 11 which detects engine-cooling-water temperature, and the air flow meter 13 and flueway 14 which detect an intake air flow are equipped with the air-fuel ratio sensor 15 which detects an air-fuel ratio through detection of the oxygen density under exhaust air etc. at the upper section of the inhalation-of-air path 12.

[0020] The detecting signal from said various sensors is outputted to a control unit 16, and a control unit 16 outputs a fuel-injection signal to said fuel injection valve 6 based on these detecting signals, performs fuel-injection control, outputs an ignition signal to said ignition coil 9, performs ignition control, further, it outputs a valve driving signal to said valve driving gear, and controls closing motion of an inlet valve 3 and an exhaust valve 4.

[0021] the electromagnetism which serves as said inlet valve 3 and an exhaust valve 4 from the valve driving gear 2 for driving these here -- the hardware of a moving valve mechanism is explained based on drawing 2 . In drawing 2 , the exhaust valve 4 is attached in the cylinder head 18 by the same approach as usual. Namely, the stem 31 of an exhaust valve 4 is inserted in the valve guide 19 prepared in the cylinder head 18 at sliding freedom, the upper sheet 32 is attached in a stem 31 up edge through a valve cotter etc., and an exhaust valve 4 is energized in the direction of clausilium between this upper sheet 32 and ROASHITO by the side of the cylinder head (specified quantity compression was carried out by free length). The spring 33 for clausiliums is arranged.

[0022] And in the condition of adsorbing the armature with the electromagnet 43 for clausiliums which an exhaust valve 4 mentions later by the closed state, from the upper bed section of said stem 31, if specified quantity alienation is carried out and it puts in another way, it has predetermined valve clearance, and the movable shaft 40 of the valve driving gear 2 is arranged on said stem 31 and same axle.

[0023] The armature 42 which said valve driving gear 2 is formed in the housing 41 made from non-magnetic material, and said good driving axle 40 at one, and is contained by sliding freedom in housing 41, The electromagnet 43 for clausiliums placed in a fixed position in housing 42 in this armature 42 in the location which counters the top face of an armature 42 possible [ magnetic attraction ], It consists of locations which carry out magnetic attraction of this armature 42, and counter the underside of an armature 42 possible [ valve-opening maintenance of an exhaust valve 4 ] including the electromagnet 44 for valve opening placed in a fixed position in housing 41, and the spring 45 for valve opening which energizes an armature 42 towards the valve-opening direction of an exhaust valve 4.

[0024] As shown in drawing 3 , when both the electromagnet 43 for clausiliums and the electromagnet 44 for valve opening are demagnetized, and an exhaust valve 4 If it is constituted so that it may become a half-opening location, and energization excitation only of said electromagnet 43 for clausiliums is carried out from this half-opening location If magnetic attraction of the armature 42 is carried out in the direction which pushes and contracts the spring 45 for valve opening by the electromagnet 43 for clausiliums and energization excitation only of the electromagnet 44 for valve opening is carried out from said half-opening location on the other hand Magnetic attraction of the armature 42 is carried out in the direction which pushes and contracts the spring 33 for clausiliums and opens an exhaust valve 4 by the electromagnet 44 for valve opening.

[0025] Moreover, energization control of said electromagnet 43 for clausiliums and the electromagnet 44 for valve opening is carried out so that it may drive in the property that this armature 42 has a target rate corresponding to each location in the housing top wall of said valve driving gear 2 while it is equipped with the position sensor 51 which detects the location of said armature 42 and this position sensor 51 detects the location of an armature 42. It is controllable to make it stop in a location just before it sits an electromagnet at a sufficiently small rate after approaching the electromagnet of this another side, and easing the impact at the time of taking a seat or sitting down on an electromagnet, and to prevent a collision, driving an armature 42 at a rate with the big actuation middle which faces to the electromagnet of another side after leaving one electromagnet, and securing responsibility by this.

[0026] As mentioned above, although the switching action of an exhaust valve 4 was shown, it completely operates similarly by the same configuration about an inlet valve 3. And initialization which holds said inlet valve 3 and exhaust valve 4 from said half-opening location to an open position or a closed position before start up is performed. After this initialization energizes the electromagnet 44 for valve opening, and the electromagnet 43 for clausiliums by turns as mentioned already, it causes resonance phenomena in an operation of springs 33 and 45 and increases the amplitude, it is performed by holding to an open position or a closed position (refer to drawing 4 ).

[0027] Amendment of the detection value of said position sensor 51, i.e., the relation between an output value (electrical potential difference) and the detection value of armature 42 location, is amended immediately after the above-mentioned initialization (only henceforth amendment of a position sensor 51).

[0028] Below, the gestalt of each implementation of amendment of the detection value of said position sensor 51 is explained. With the gestalt of the 1st operation, since it is made to differ from



the closing motion location of the inlet valve 3 after initialization, and the closing motion location of an exhaust valve 4 and is set up for cranking after initialization, a position sensor 51 is amended based on the output value of the position sensor 51 according to the full admission (or close) location of the inlet valve 3 immediately after initialization, and the output value of the position sensor 51 according to the close (or full admission) location of an exhaust valve 4.

[0029] Drawing 5 shows the appearance of initialization of an inlet valve 3 and an exhaust valve 4, the inlet valve 3 after initialization is held in a closed position HIC, and an exhaust valve is held at an open position HEO. In addition, as shown in an alternate long and short dash line, the inlet valve 3 after initialization is held at an open position, and an exhaust valve 4 may be made to be held in a closed position.

[0030] Drawing 6 shows the situation of amendment of the detection value of the position sensor 51 in the gestalt of said 1st operation, and amends as a property of connecting the output value VIC of the position sensor 51 corresponding to the closed position HIC of an inlet valve 3, and the output value VEO of the position sensor 51 corresponding to the open position HEO of an exhaust valve 4 in a straight line. Thereby, to the property of the valve displacement (armature location) by the sensor output before the amendment shown by the dotted line, as shown by the graphic display arrow head, open-position amendment and closed position amendment are performed, and according to this, a medium opening is amended further.

[0031] The gestalt of this operation is setting out of the usual initialization of changing the closing motion location of an inlet valve 3, and the closing motion location of an exhaust valve 4, and can be most simply amended based on the output value of the position sensor 51 detected as it is. However, in order to perform common amendment using the output value of a different position sensor 51 to the valve of a different class of an inlet valve 3 and an exhaust valve 4, there is room of an improvement in precision.

[0032] So, with the gestalt of the 2nd operation, although it becomes a little [ in control ] complicated, the closing motion location of the inlet valve 3 after initialization and the closing motion location of an exhaust valve 4 are changed between cylinders, for example, in the 1st cylinder, an inlet valve 3 is held to open-position #1HIO, and an exhaust valve 4 is held to closed position #1HEC, and in the 2nd cylinder, it sets up so that an inlet valve 3 may be held to closed position #2HIC and an exhaust valve 4 may be held to open-position #2HEO (refer to drawing 7 ). And it is based on output-value #1VIO of the position sensor 51 corresponding to open-position #1HIO of the cylinder [ 1st ] inlet valve 3 after initialization, and output-value #2VIC of the position sensor 51 corresponding to closed position #2HIC of the cylinder [ 2nd ] inlet valve 3. It is made said this appearance about an inlet valve 3, and a position sensor 51 is amended. Again Based on output-value #1VEC of the position sensor 51 corresponding to closed position #1HEC of the cylinder [ 1st ] exhaust valve 4, and output-value #2VEO of the position sensor 51 corresponding to open-position #2HEO of the cylinder [ 2nd ] exhaust valve 4, a position sensor 51 is amended about an exhaust valve 4 (refer to drawing 8 ).

[0033] If it does in this way, although it is a different valve, since amendment is performed based on the output value of the position sensor 51 to the valve of congener (inlet valves or exhaust valves), the precision of amendment will improve.

[0034] Next, the gestalt of the 3rd operation is explained. With the gestalt of this operation, a position sensor 51 is amended about an inlet valve 3 and an exhaust valve 4 based on the output value of the position sensor 51 in the half-opening location before initialization, and the output value of the position sensor 51 in the open position or closed position after initialization, respectively.

[0035] Drawing 9 shows the case where it is set up so that an inlet valve 3 may be held in a closed position HIC and an exhaust valve 4 may be held after initialization at an open position HEO. About an inlet valve 3 It amends based on the output value VIM of the half-opening location HIM before initialization, and the output value VIC of the closed position HIC after initialization (refer to drawing 10 ). About an exhaust valve 4 It amends based on the output value VEM of the half-opening location HEM before initialization, and the output value VEO of the open position HEO after initialization (refer to drawing 11 ). Specifically perform amendment which connects the output value VIM of the half-opening location HIM of an inlet valve 3, and the output value VIC of a closed position HIC in a straight line, and the output value corresponding to 2 (HIM-HIC) of an open

position is estimated at [VIC+2 (VIM-VIC)]. Amendment which connects the output value VEM of the half-opening location HEM of an exhaust valve 4 and the output value VEO of an open position HEO in a straight line similarly is performed, and the output value corresponding to HEO-2 (HEO-HIM) of a closed position is estimated at [VEO-2 (VEO-VIM)].

[0036] If it does in this way, it can amend simply like the gestalt of the 1st operation using the output value of the position sensor 51 in setting out of the usual initialization. Although it improves depending on using two output values of the position sensor 51 of the identities in the same valve about precision, since the closing motion location after initialization is estimate, it may fall a little about the output value in a different closing motion location.

[0037] In addition, the gestalt of the above-mentioned implementation of the closing motion location after initialization of an inlet valve 3 and an exhaust valve 4 can be similarly performed, even if it sets up reversely. Next, the gestalt of the 4th operation is explained.

[0038] With the gestalt of this operation, it is made to hold temporarily about an inlet valve 3 and an exhaust valve 4 in a different closing motion location from the closing motion location after initialization at the time of engine shutdown, respectively, and the output value of the position sensor 51 corresponding to this closing motion location is memorized in memory. And based on the output value after initialization before start up, and the output value memorized last time at the time of shutdown, a position sensor 51 is amended about an inlet valve 3 and an exhaust valve 4, respectively.

[0039] At the time of an engine operation halt, an inlet valve 3 is held to an open position HIOE, drawing 12 holds an exhaust valve 4 to a closed position HECE temporarily, and after initialization shows the case where held the inlet valve 3 to the closed position HICS, and it holds an exhaust valve 4 to an open position HEOS.

[0040] About an inlet valve 3, the output value VIOE of the open position HIOE at the time of shutdown It amends based on the output value VICS of the closed position HICS after initialization (refer to drawing 13 ). About an exhaust valve 4 it amends based on the output value VECE of the closed position HECE at the time of shutdown, and the output value VEOS of the open position HEOS after initialization (refer to drawing 14 ), if it does in this way The highly precise location sensor 51 can be amended by using the output value corresponding to the open position of the same valve, and the output value corresponding to a closed position.

[0041] In addition, even if the above sets up the closing motion location the time of an engine operation halt of an inlet valve 3 and an exhaust valve 4, and after initialization reversely, it can perform similarly. However, in the time of an engine operation halt and start up, generally there is a temperature gradient, and if there is a temperature gradient, the output value of a position sensor 51 will change.

[0042] So, with the gestalt of the 5th operation, a temperature gradient with the time of said engine operation halt and start up is amended. Like the gestalt of the 4th operation, an inlet valve 3 is held to an open position HIOE, an exhaust valve 4 is temporarily, held to a closed position HECE at the time of an engine operation halt, and after initialization explains the case where held the inlet valve 3 to the closed position HICS, and it holds an exhaust valve 4 to an open position HEOS.

[0043] The water temperature TwE detected by said coolant temperature sensor 11 at the time of an engine operation halt is memorized, and temperature-gradient  $\Delta Tw (= TwS - TwE)$  with the water temperature TwS detected at the time of start up is computed.

[0044] And by amendment part  $\Delta VIOS$  according to said temperature-gradient  $\Delta Tw$ , the output value VIOE of the position sensor 51 corresponding to the open position HIOE of the inlet valve 3 at the time of an engine operation halt is amended, and said same linear interpolation etc. amends it based on the this amended output value (VIOE- $\Delta VIOS$ ) and the output value VICS corresponding to the closed position HICS after initialization the time of start up (refer to drawing 15 ).

[0045] Similarly, the output value VECE corresponding to the closed position HECE of the exhaust valve 4 at the time of an engine operation halt is amended by amendment part  $\Delta VECS$  according to said temperature-gradient  $\Delta Tw$ , and linear interpolation etc. amends the exhaust valve 4 after initialization based on an open position HEOS at the time of the this amended output value (VECS- $\Delta VECS$ ) and start up (refer to drawing 16 ).

[0046] Thus, by amending the relation between the output value of the location sensor 51, and the detection value of armature 42 location, after performing output-value amendment of a temperature gradient, it can amend with a more sufficient precision.

[0047] In addition, as an alternate long and short dash line shows, the oil-temperature sensor 17 may be formed in the valve driving gear 2 at drawing 1 , said temperature-gradient amendment may be performed using whenever [ near the valve element sliding section of the intake/exhaust valve detected by this oil-temperature sensor 17 / temperature-of-lubricating-oil ], and highly precise temperature-gradient amendment can be performed.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] System configuration drawing of the engine in the gestalt of operation.

[Drawing 2] the electromagnetism in the gestalt of operation -- the sectional view showing the configuration at the time of the intake/exhaust valve clausilium condition of a moving valve mechanism.

[Drawing 3] the same as the above -- electromagnetism -- the sectional view showing the configuration at the time of the inlet-valve half-opening condition of a moving valve mechanism.

[Drawing 4] The timing diagram which shows the situation of resonance initialization control of an intake/exhaust valve.

[Drawing 5] the armature when carrying out resonance initialization of the inlet valve and exhaust valve in a gestalt of the 1st operation in a different closing motion location -- the timing diagram which shows the situation of a variation rate.

[Drawing 6] Drawing showing the situation of amendment of the position sensor in the gestalt of operation same as the above.

[Drawing 7] the armature when carrying out resonance initialization of the inlet valves and exhaust valves in a gestalt of the 2nd operation in a different closing motion location between cylinders -- the timing diagram which shows the situation of a variation rate.

[Drawing 8] Drawing showing the situation of amendment of the position sensor in the gestalt of operation same as the above.

[Drawing 9] the armature of the time of carrying out resonance initialization in a closing motion location different initialization before of the inlet valve in the gestalt of the 3rd operation, and an exhaust valve, and \*\* -- the timing diagram which shows the situation of a variation rate.

[Drawing 10] Drawing showing the situation of amendment of the position sensor by the side of the inlet valve in the gestalt of operation same as the above.

[Drawing 11] Drawing showing the situation of amendment of the position sensor by the side of the exhaust valve in the gestalt of operation same as the above.

[Drawing 12] the armature of the time of an engine operation halt of the inlet valve in the gestalt of the 4th operation and an exhaust valve, the time of carrying out resonance initialization in a different closing motion location, and \*\* -- the timing diagram which shows the situation of a variation rate.

[Drawing 13] Drawing showing the situation of amendment of the position sensor by the side of the inlet valve in the gestalt of operation same as the above.

[Drawing 14] Drawing showing the situation of amendment of the position sensor by the side of the exhaust valve in the gestalt of operation same as the above.

[Drawing 15] Drawing showing the situation of amendment of the position sensor by the side of the inlet valve in the gestalt of the 5th operation.

[Drawing 16] Drawing showing the situation of amendment of the position sensor by the side of the exhaust valve in the gestalt of operation same as the above.

[Description of Notations]

- 1 Engine
- 2 Valve Driving Gear
- 3 Inlet Valve
- 4 Exhaust Valve

10 Crank Angle Sensor  
11 Control Unit  
33 Spring for Clausiliums  
42 Armature  
43 Electromagnet for Clausiliums  
44 Electromagnet for Valve Opening  
45 Spring for Valve Opening

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[Translation done.]

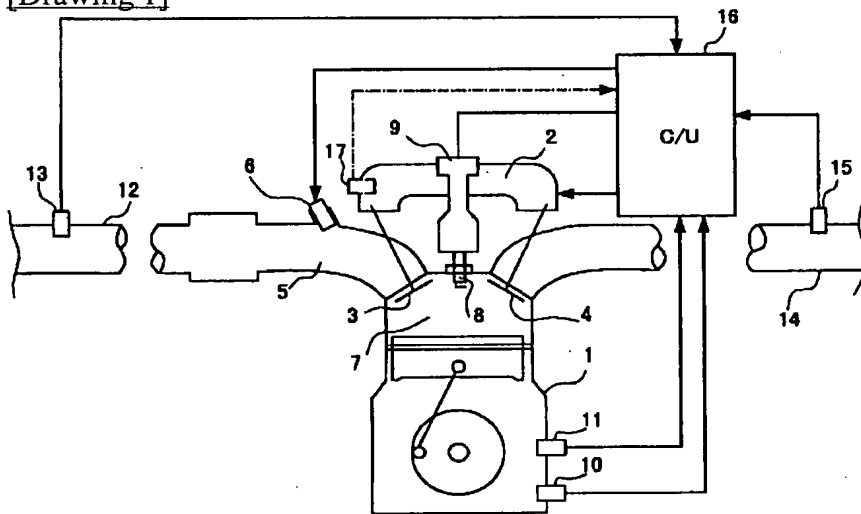
## \* NOTICES \*

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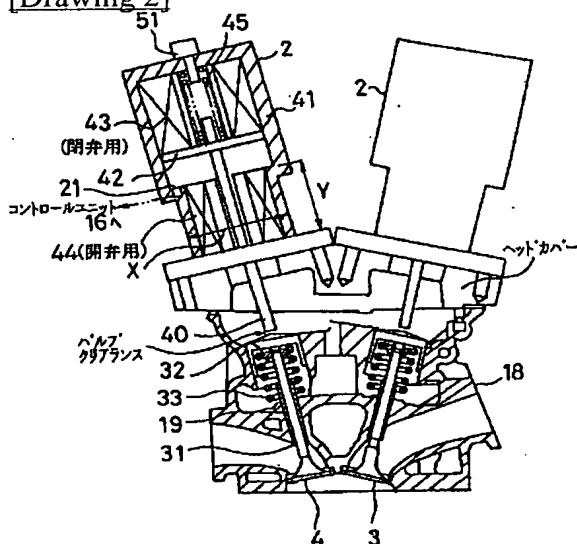
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DRAWINGS

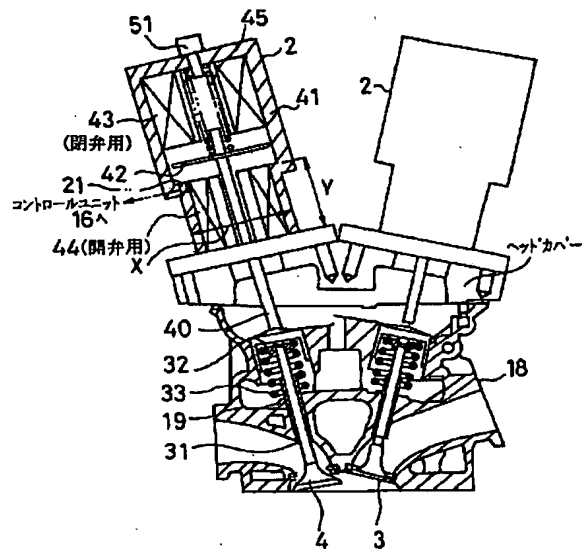
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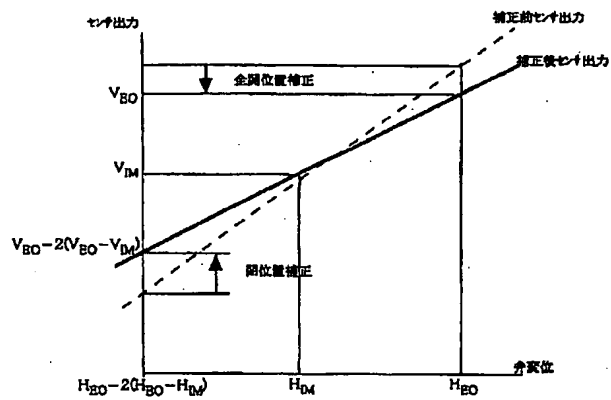
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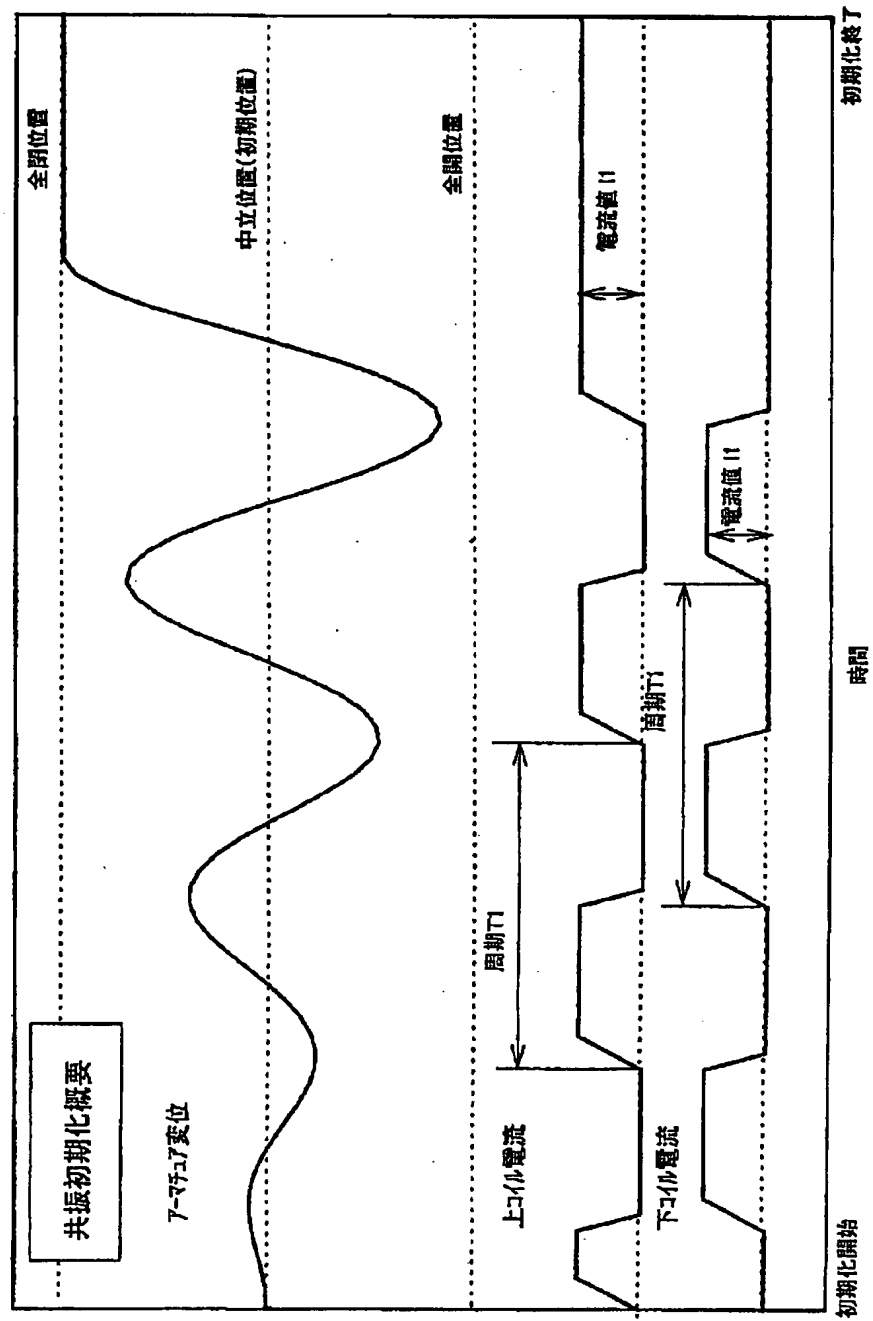
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[Drawing 11]

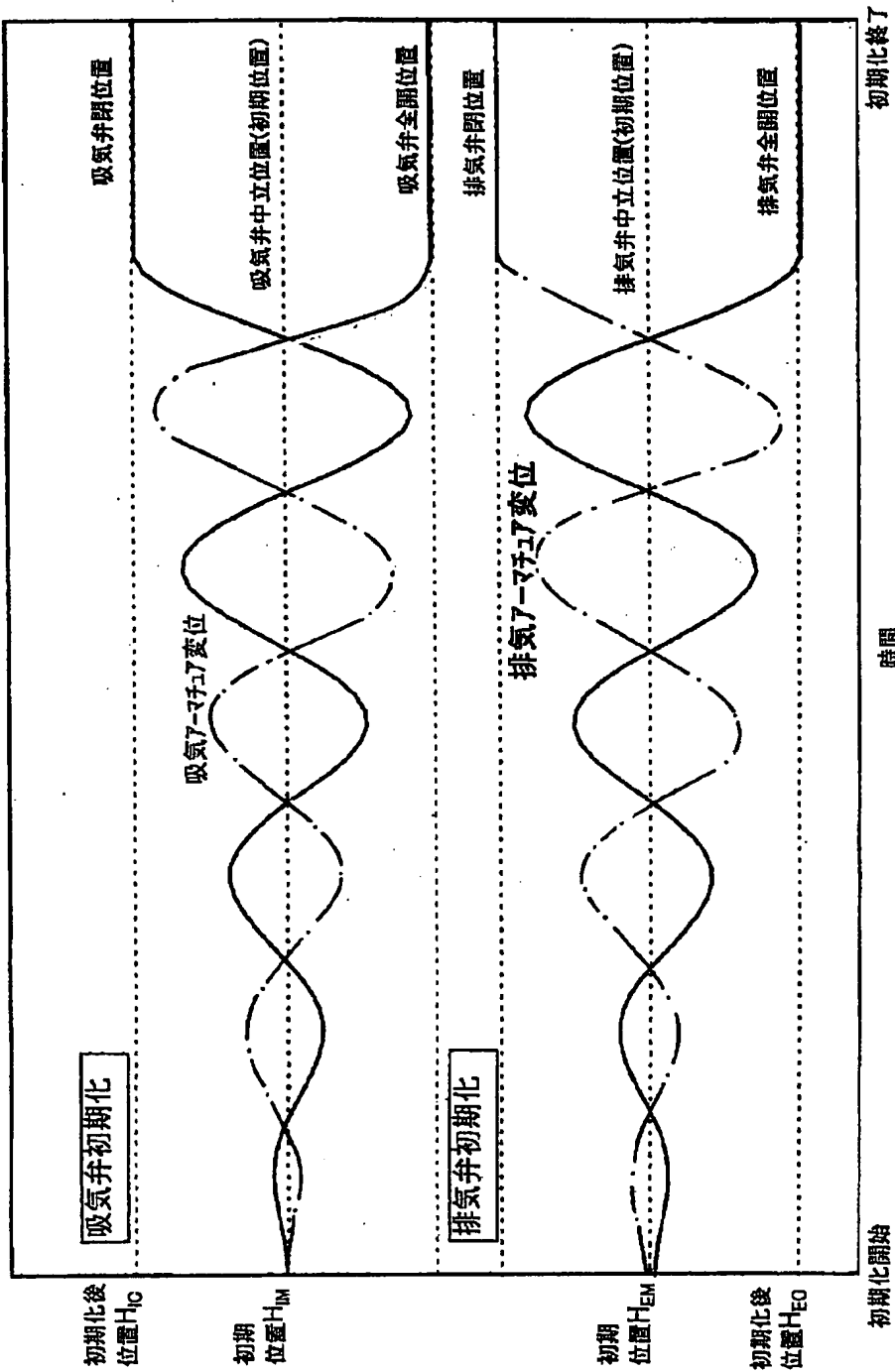


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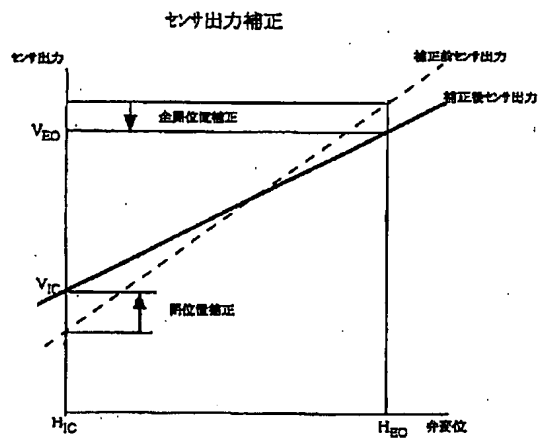


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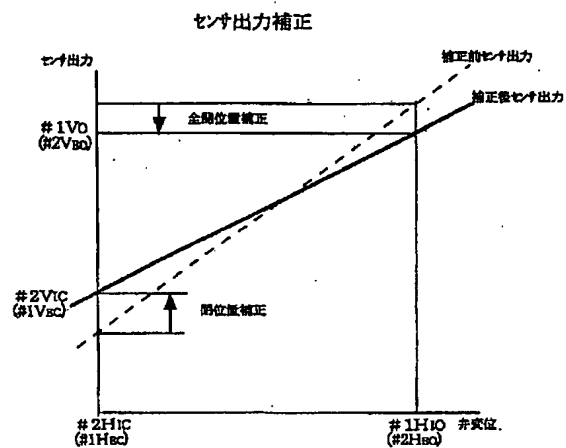




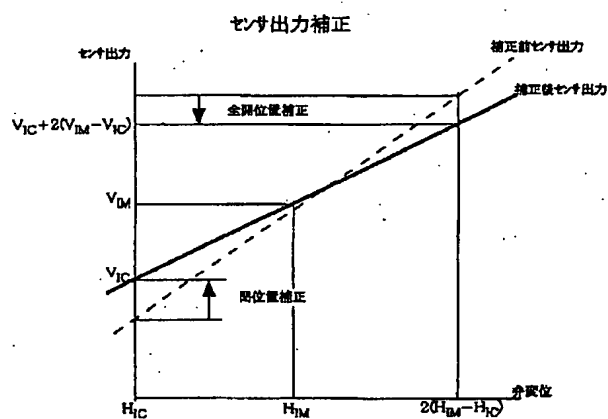
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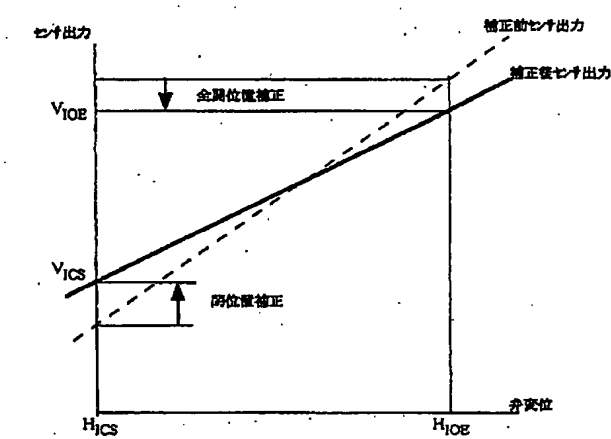
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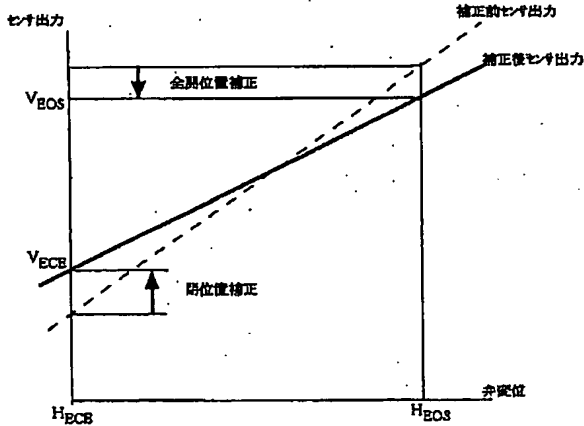
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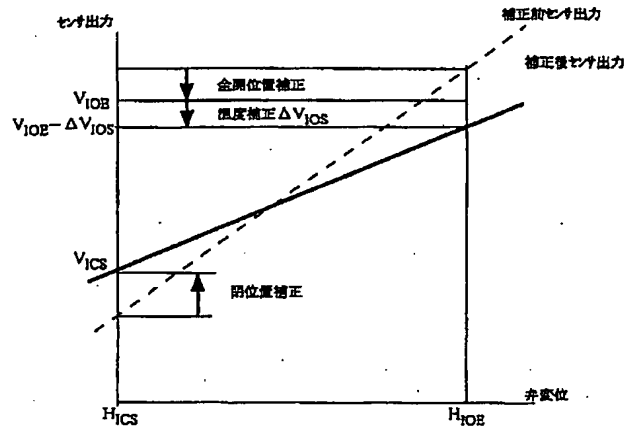
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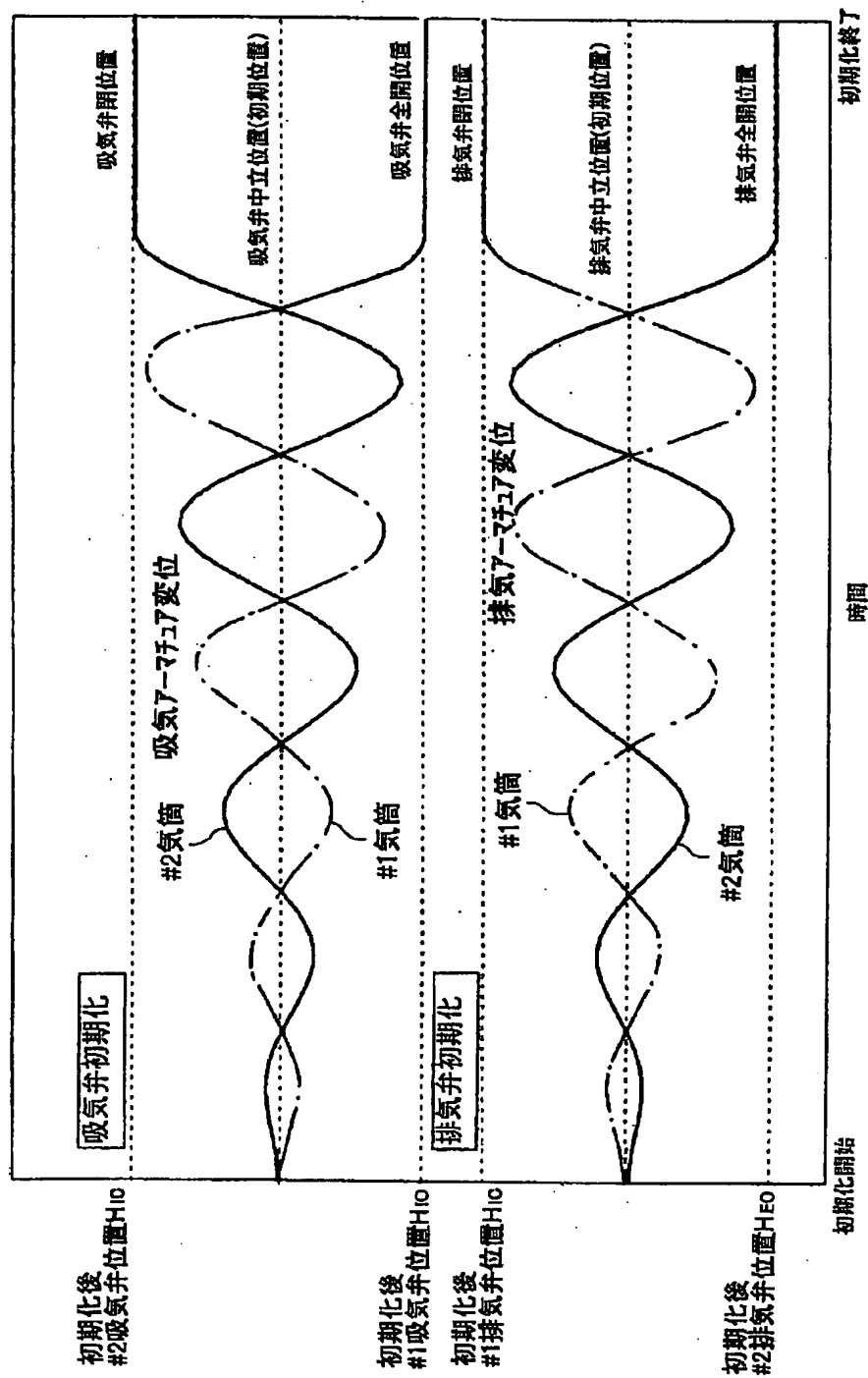
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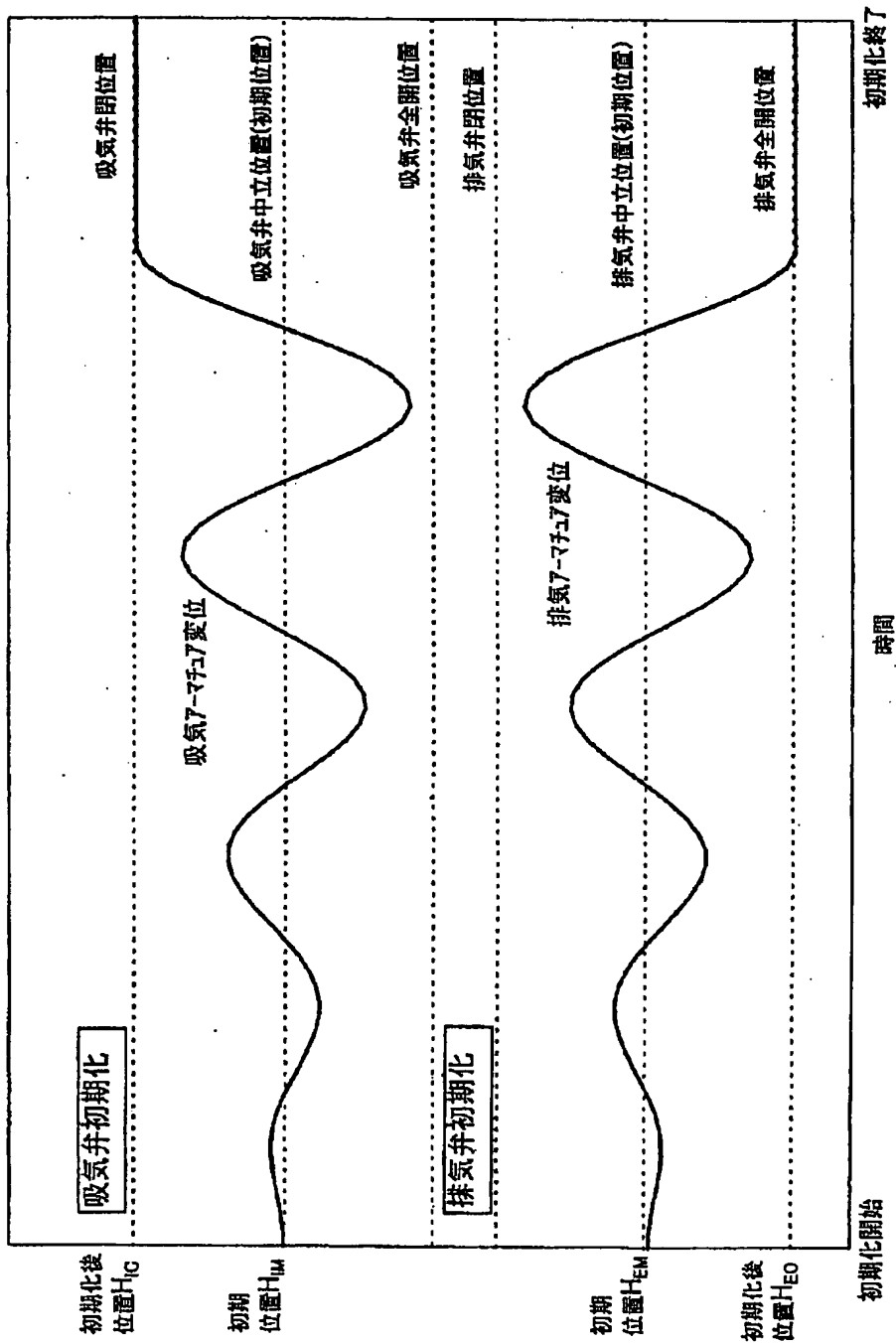
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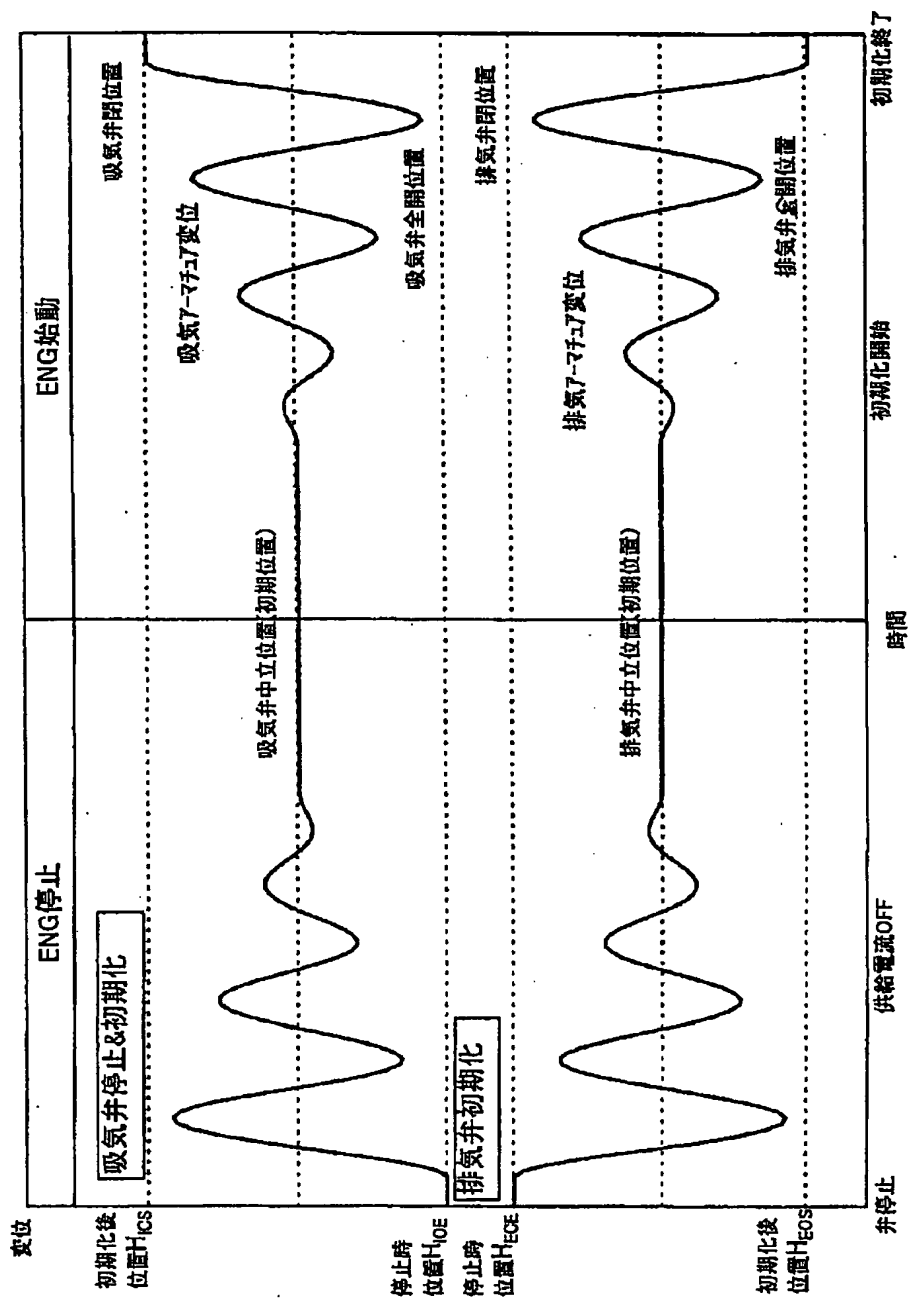
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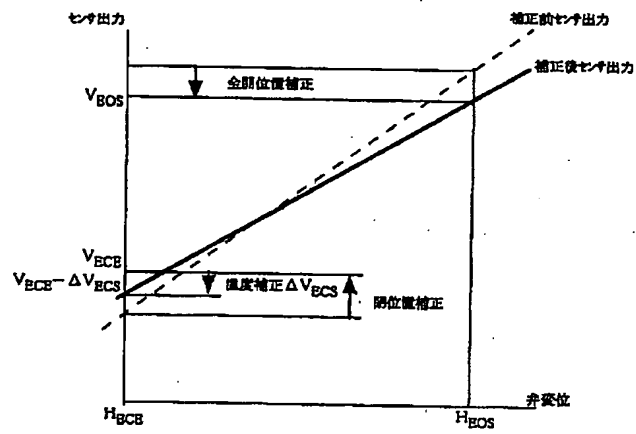
[Drawing 9]



[Drawing 12]



[Drawing 16]



[Translation done.]

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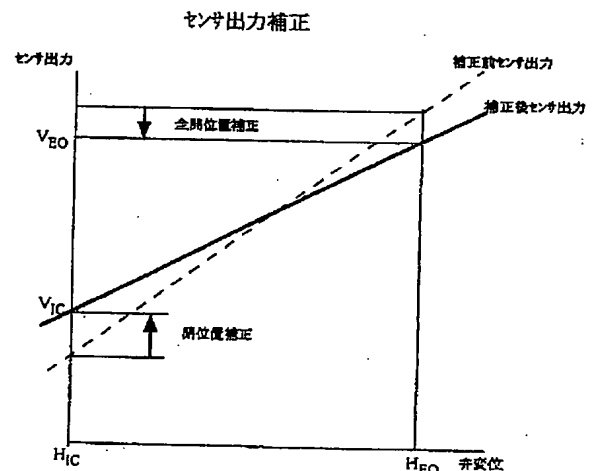
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(54) 【発明の名称】 エンジンの電磁動弁制御装置

(57) 【要約】

【課題】エンジンの電磁動弁（吸・排気弁）の制御に使用されるアーマチャ位置を検出する位置センサの検出精度を確保する。

【解決手段】始動前に吸気弁を閉位置HIC（又は全開位置）、排気弁を全開位置HEO（又は閉位置）に保持する初期化を行ない、吸気弁に対応するアーマチャ位置を検出する位置センサの前記吸気弁閉位置における出力値VICと、排気弁に対応するアーマチャ位置を検出する位置センサの前記排気弁全開位置における出力値VEOとに基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正する。





## 【特許請求の範囲】

【請求項 1】吸・排気弁を半開位置に付勢するスプリングと、吸・排気弁を開弁方向に吸引して全開位置に保持する開弁用電磁石と、吸・排気弁を閉弁方向に吸着して閉位置に保持する閉弁用電磁石と、を備え、エンジン始動前に吸・排気弁を全開位置若しくは閉位置に保持させて初期化を行なった後、前記各電磁石に共通なアーマチャの位置を位置センサで検出しつつ該各電磁石を通電制御するエンジンの電磁動弁制御装置において、前記初期化後の開閉位置を相互に異ならせた吸・排気弁に設けられた位置センサにおける該吸・排気弁の初期化後の全開位置と閉位置とに対応する 2 つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とするエンジンの電磁動弁制御装置。

【請求項 2】吸気弁の前記初期化後の開閉位置と、排気弁の前記初期化後の開閉位置とを異ならせ、これらの初期化後における位置センサの 2 つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする請求項 1 に記載のエンジンの電磁動弁制御装置。

【請求項 3】気筒間で前記初期化後の開閉位置を異ならせた吸気弁同士又は排気弁同士の初期化後における位置センサの 2 つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする請求項 1 に記載のエンジンの電磁動弁制御装置。

【請求項 4】吸・排気弁を半開位置に付勢するスプリングと、吸・排気弁を開弁方向に吸引して全開位置に保持する開弁用電磁石と、吸・排気弁を閉弁方向に吸着して閉位置に保持する閉弁用電磁石と、を備え、エンジン始動前に吸・排気弁を全開位置若しくは閉位置に保持させて初期化を行なった後、前記各電磁石に共通なアーマチャの位置を位置センサで検出しつつ該各電磁石を通電制御するエンジンの電磁動弁制御装置において、前記位置センサにおける吸・排気弁の初期化前の半開位置に対応する出力値と該吸・排気弁の初期化後における全開位置又は閉位置に対応する出力値とに基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とするエンジンの電磁動弁制御装置。

【請求項 5】吸・排気弁を半開位置に付勢するスプリングと、吸・排気弁を開弁方向に吸引して全開位置に保持する開弁用電磁石と、吸・排気弁を閉弁方向に吸着して閉位置に保持する閉弁用電磁石と、を備え、エンジン始動前に吸・排気弁を全開位置若しくは閉位置に保持させて初期化を行なった後、前記各電磁石に共通なアーマチャの位置を位置センサで検出しつつ該各電磁石を通電制御するエンジンの電磁動弁制御装置において、エンジン運転停止時に吸・排気弁を前記初期化後の開閉

位置とは異なる開閉位置に一時的に保持して、該保持された開閉位置における位置センサの出力値を記憶し、該位置センサの前記記憶された出力値と前記初期化後の吸・排気弁開閉位置における出力値とに基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とするエンジンの電磁動弁制御装置。

【請求項 6】前記位置センサ周辺の温度状態を検出し、前記エンジン運転停止時と始動時との温度差に応じて位置センサの出力値を補正した上で、前記位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする請求項 5 に記載のエンジンの電磁動弁制御装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、スプリングによって半開位置に付勢される吸・排気弁を、始動前に全開位置又は閉位置に保持する初期化を行うエンジンの電磁動弁制御装置に関し、特に電磁石のアーマチャの位置を検出するセンサの始動時補正に関する。

【0002】

【従来の技術】この種の電磁動弁装置としては、一対のスプリングによる付勢力により、半開位置に支持される弁体（吸・排気弁）を、該弁体に連係したアーマチャに電磁力を作用させて、前記半開位置から全開又は閉方向に移動させる構造であり、始動前に全開位置又は閉位置に保持する初期化を行う。その後、開弁時は開弁用電磁石の通電を停止してスプリングの付勢力で弁体を開弁方向に移動させ、開弁用電磁石に十分接近したところから該開弁用電磁石を通電して全開位置に吸着保持し、閉弁時は、開弁用電磁石の通電を停止してスプリングの付勢力で弁体を閉弁方向へ移動させ、閉弁用電磁石に十分接近したところから該閉弁用電磁石を通電して閉位置に吸着保持する開閉制御を行なっている。

【0003】ところで、前記開弁用電磁石及び閉弁用電磁石の通電制御は、電磁石のアーマチャの位置を位置センサによって検出しつつ位置毎の目標速度を達成するようにフィードバック制御して行なっている。該通電制御は、アーマチャや弁体の着座時の速度を十分小さくして衝撃を緩和し、かつ、応答性も確保されるように高精度に行なう必要があり、そのためには、前記位置センサによるアーマチャ位置の検出精度を確保する必要がある。

【0004】しかしながら、電磁動弁各部の摩耗等によりアーマチャ位置が経時変化するため、アーマチャ位置の検出精度が低下してしまう。本発明は、このような従来の課題に着目してなされたもので、エンジンの電磁動弁制御装置において、電磁石のアーマチャの位置を検出する位置センサの検出値を適切に補正することにより、アーマチャ位置を常時高精度に検出でき、以って高精度な吸・排気弁の開閉制御を行なえるようにすることを目的とする。

【0005】

【課題を解決するための手段】このため請求項1に係る発明は、吸・排気弁を半開位置に付勢するスプリングと、吸・排気弁を開弁方向に吸引して全開位置に保持する開弁用電磁石と、吸・排気弁を開弁方向に吸着して閉位置に保持する閉弁用電磁石と、を備え、エンジン始動前に吸・排気弁を全開位置若しくは閉位置に保持させて初期化を行なった後、前記各電磁石に共通なアーマチャの位置を位置センサで検出しつつ該各電磁石を通電制御するエンジンの電磁動弁制御装置において、前記初期化後の開閉位置を相互に異ならせた吸・排気弁に設けられた位置センサにおける該吸・排気弁の初期化後の全開位置と閉位置とに対応する2つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする。

【0006】請求項1に係る発明によると、初期化後の開閉位置を相互に異ならせた吸・排気弁にそれぞれ設けられた位置センサにより、該吸・排気弁の初期化後の全開位置と閉位置とに対応した2つの出力値が得られる。該2つの出力値は、それぞれ吸・排気弁の全開位置と閉位置とにおけるアーマチャの両端位置に対応するので、これら2つの出力値に基づいて位置センサの出力値とアーマチャ位置の検出値との関係を補正する。

【0007】このようにすれば、始動時毎に位置センサの補正が行なわれるので、アーマチャ位置の検出精度が高められ、以って吸・排気弁の開閉制御精度が高められる。また、請求項2に係る発明は、吸気弁の前記初期化後の開閉位置と、排気弁の前記初期化後の開閉位置とを異ならせ、これらの初期化後における位置センサの2つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする。

【0008】請求項2に係る発明によると、通常、初期化後のクランキングのため、初期化後における吸気弁の開閉位置と排気弁の開閉位置とは異なるように設定されるので、該初期化後の吸気弁の開閉位置と排気弁の開閉位置とに対応する位置センサの2つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正する。

【0009】このようにすれば、通常初期化の設定で、そのまま検出される位置センサの出力値に基づいて最も簡易に補正を行なうことができる。また、請求項3に係る発明は、気筒間で前記初期化後の開閉位置を異ならせた吸気弁同士又は排気弁同士の初期化後における位置センサの2つの出力値に基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする。

【0010】請求項3に係る発明によると、異なる弁ではあるが同種（吸気弁同士又は排気弁同士）の弁に対する位置センサの出力値に基づいて補正が行なわれるので補正の精度が向上する。

【0011】また、請求項4に係る発明は、吸・排気弁を半開位置に付勢するスプリングと、吸・排気弁を開弁方向に吸引して全開位置に保持する開弁用電磁石と、吸・排気弁を開弁方向に吸着して閉位置に保持する閉弁用電磁石と、を備え、エンジン始動前に吸・排気弁を全開位置若しくは閉位置に保持させて初期化を行なった後、前記各電磁石に共通なアーマチャの位置を位置センサで検出しつつ該各電磁石を通電制御するエンジンの電磁動弁制御装置において、前記位置センサにおける吸・排気弁の初期化前の半開位置に対応する出力値と該吸・排気弁の初期化後における全開位置又は閉位置に対応する出力値とに基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする。

【0012】請求項4に係る発明によると、位置センサにより、吸・排気弁の初期化前の半開位置に対応する出力値と該吸・排気弁の初期化後における全開位置又は閉位置に対応する出力値とが得られるので、該2つの出力値に基づいて位置センサの出力値とアーマチャ位置の検出値との関係を補正する。

【0013】このようにすれば、通常初期化の設定における位置センサの出力値を用いて簡易に補正を行なえ、同一の弁における同一の位置センサの2つの出力値を用いることによって、検出精度が向上する。

【0014】また、請求項5に係る発明は、吸・排気弁を半開位置に付勢するスプリングと、吸・排気弁を開弁方向に吸引して全開位置に保持する開弁用電磁石と、吸・排気弁を開弁方向に吸着して閉位置に保持する閉弁用電磁石と、を備え、エンジン始動前に吸・排気弁を全開位置若しくは閉位置に保持させて初期化を行なった後、前記各電磁石に共通なアーマチャの位置を位置センサで検出しつつ該各電磁石を通電制御するエンジンの電磁動弁制御装置において、エンジン運転停止時に吸・排気弁を前記初期化後の開閉位置とは異なる開閉位置に一時的に保持して、該保持された開閉位置における位置センサの出力値を記憶し、該位置センサの前記記憶された出力値と前記初期化後の吸・排気弁開閉位置における出力値とに基づいて、位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする。

【0015】請求項5に係る発明によると、位置センサにより、エンジン運転停止時における吸・排気弁の開閉位置に対応する出力値と該開閉位置とは異なる吸・排気弁の初期化後における開閉位置に対応する出力値とが得られるので、該2つの出力値に基づいて位置センサの出力値とアーマチャ位置の検出値との関係を補正する。

【0016】このようにすれば、同一の弁の全開位置に対応する出力値と閉位置に対応する出力値とを用いることで、より高精度な位置センサの補正を行なうことができる。

【0017】また、請求項6に係る発明は、前記位置センサ周辺の温度状態を検出し、前記エンジン運転停止時

と始動時との温度差に応じて位置センサの出力値を補正した上で、前記位置センサの出力値とアーマチャ位置の検出値との関係を補正することを特徴とする。

【0018】請求項6に係る発明によると、このようにすれば、温度差の出力値補正を行なった上で位置センサの出力値とアーマチャ位置の検出値との関係を補正することにより、さらに高精度な位置センサの補正を行なうことができる。

【0019】

【発明の実施の形態】以下、本発明の実施形態を図に基づいて説明する。本発明の一実施形態のシステム構成を示す図1において、エンジン1には、弁駆動装置2により開閉を電子制御される吸気弁3及び排気弁4が装着されている。各気筒の吸気ポート5には、燃料噴射弁6が装着され、燃焼室7には点火栓8及び点火コイル9が装着されている。また、エンジン本体には、各気筒の基準クランク角で基準信号を出力すると共に微小クランク角毎に単位角信号を出力するクランク角センサ10、エンジン冷却水温度を検出する水温センサ11が装着され、吸気通路12の上流部には、吸入空気流量を検出するエアフロメータ13、排気通路14には、排気中の酸素濃度等の検出を介して空燃比を検出する空燃比センサ15が装着されている。

【0020】前記各種センサ類からの検出信号はコントロールユニット16に出力され、コントロールユニット16は、これらの検出信号に基づいて前記燃料噴射弁6に燃料噴射信号を出力して燃料噴射制御を行い、前記点火コイル9に点火信号を出力して点火制御を行い、更に、前記弁駆動装置に弁駆動信号を出力して吸気弁3及び排気弁4の開閉を制御する。

【0021】ここで、前記吸気弁3及び排気弁4と、これらを駆動するための弁駆動装置2からなる電磁動弁装置のハードウェアについて、図2に基づいて説明する。図2において、シリンダヘッド18に従来と同様の方法で、排気弁4は取り付けられている。即ち、シリンダヘッド18に設けられるバルブガイド19に、排気弁4のステム31が摺動自由に挿通されており、ステム31上端部には、バルブコッター等を介してアッパーシート32が取り付けられ、該アッパーシート32と、シリンダヘッド側のロアシートとの間に、排気弁4を開弁方向に付勢する（自由長から所定量圧縮された）閉弁用スプリング33が配設されている。

【0022】そして、排気弁4が閉状態で、後述する閉弁用電磁石43でアーマチャを吸着している状態において、前記ステム31の上端部から、所定量離間して、言い換えれば所定のバルブクリアランスを持って、弁駆動装置2の可動軸40が、前記ステム31と同軸上に配設されるようになっている。

【0023】前記弁駆動装置2は、非磁性体製のハウジング41と、前記可動軸40に一体に設けられてハウジ

ング41内に摺動自由に収納されるアーマチャ42と、該アーマチャ42を磁気吸引可能にアーマチャ42の上面に対向する位置でハウジング42内に固定配置される閉弁用電磁石43と、該アーマチャ42を磁気吸引して排気弁4を開弁保持可能にアーマチャ42の下面に対向する位置でハウジング41内に固定配置される開弁用電磁石44と、排気弁4の開弁方向に向けてアーマチャ42を付勢する開弁用スプリング45と、を含んで構成されている。

【0024】そして、図3に示すように、閉弁用電磁石43と開弁用電磁石44とを共に消磁したときに、排気弁4は、半開位置となるように構成されており、この半開位置から前記閉弁用電磁石43のみを通電励磁すると、アーマチャ42は開弁用スプリング45を押し縮める方向に閉弁用電磁石43によって磁気吸引され、一方前記半開位置から開弁用電磁石44のみを通電励磁すると、アーマチャ42は閉弁用スプリング33を押し縮めて排気弁4を開弁する方向に開弁用電磁石44によって磁気吸引される。

【0025】また、前記弁駆動装置2のハウジング頂壁には、前記アーマチャ42の位置を検出する位置センサ51が装着され、該位置センサ51によってアーマチャ42の位置を検出しながら該アーマチャ42が各位置に対応した目標速度を持つ特性で駆動されるように、前記閉弁用電磁石43と開弁用電磁石44とが通電制御される。これにより、アーマチャ42を一方の電磁石を離れてから他方の電磁石に向かう駆動途中までは大きな速度で駆動して応答性を確保しながら、該他方の電磁石に接近してからは十分小さい速度で電磁石に着座させて着座時の衝撃を緩和し、あるいは、電磁石に着座する直前の位置で停止させて衝突を防止するように制御することができる。

【0026】以上、排気弁4の開閉動作について示したが、吸気弁3についても全く同様の構成によって同様に動作する。そして、始動前に、前記吸気弁3及び排気弁4を前記半開位置から、全開位置または閉位置に保持する初期化を行う。該初期化は、既述したように開弁用電磁石44と閉弁用電磁石43とを交互に通電し、スプリング33、45の作用で共振現象を起こして振幅を増大させた後、全開位置または閉位置に保持することで行なわれる（図4参照）。

【0027】上記初期化の直後に前記位置センサ51の検出値の補正、つまり出力値（電圧）とアーマチャ42位置の検出値との関係の補正（以下単に位置センサ51の補正という）を行なう。

【0028】以下に、前記位置センサ51の検出値の補正の各実施の形態を説明する。第1の実施の形態では、初期化後のクランク角のため、初期化後の吸気弁3の開閉位置と排気弁4の開閉位置とは異ならせて設定されるので、初期化直後の吸気弁3の全開（又は閉）位置に

応じた位置センサ51の出力値と、排気弁4の開（又は全開）位置に応じた位置センサ51の出力値とに基づいて、位置センサ51の補正を行なう。

【0029】図5は、吸気弁3と排気弁4との初期化の様子を示し、初期化後吸気弁3は閉位置HICに保持され、排気弁は全開位置HE0に保持される。なお、一点鎖線に示すように、初期化後吸気弁3が全開位置に保持され、排気弁4が閉位置に保持されるようにしてもよい。

【0030】図6は、前記第1の実施の形態における位置センサ51の検出値の補正の様子を示し、吸気弁3の閉位置HICに対応する位置センサ51の出力値VICと、排気弁4の全開位置HE0に対応する位置センサ51の出力値VE0とを直線で結ぶ特性として補正を行なう。これにより、点線で示される補正前のセンサ出力と弁変位（アーマチャ位置）の特性に対し、図示矢印で示されるように全開位置補正、閉位置補正が行なわれ、これに応じてさらに中間開度が補正される。

【0031】本実施の形態は、吸気弁3の開閉位置と排気弁4の開閉位置とを異ならせるという通常の初期化の設定で、そのまま検出される位置センサ51の出力値に基づいて最も簡易に補正を行なうことができる。しかし、吸気弁3と排気弁4という異なる種類の弁に対する異なる位置センサ51の出力値を用いて、共通の補正を行なうため、精度的には改善の余地がある。

【0032】そこで、第2の実施の形態では、制御的にはやや複雑になるが気筒間で初期化後の吸気弁3の開閉位置と排気弁4の開閉位置とを異ならせ、例えば第1気筒では吸気弁3を全開位置#1HI0、排気弁4を閉位置#1HECに保持し、第2気筒では吸気弁3を閉位置#2HIC、排気弁4を全開位置#2HE0に保持するように設定する（図7参照）。そして、初期化後の第1気筒の吸気弁3の全開位置#1HI0に対応する位置センサ51の出力値#1VI0と第2気筒の吸気弁3の閉位置#2HICに対応する位置センサ51の出力値#2VICとに基づいて、吸気弁3について前記同様に位置センサ51の補正を行ない、また、第1気筒の排気弁4の閉位置#1HECに対応する位置センサ51の出力値#1VECと第2気筒の排気弁4の全開位置#2HE0に対応する位置センサ51の出力値#2VE0とに基づいて、排気弁4について位置センサ51の補正を行なう（図8参照）。

【0033】このようにすれば、異なる弁ではあるが同種（吸気弁同士又は排気弁同士）の弁に対する位置センサ51の出力値に基づいて補正が行なわれるので補正の精度が向上する。

【0034】次に、第3の実施の形態について説明する。この実施の形態では、吸気弁3及び排気弁4について、それぞれ初期化前の半開位置における位置センサ51の出力値と、初期化後の全開位置又は閉位置における位置センサ51の出力値とに基づいて、位置センサ51の補正を行なう。

【0035】図9は、初期化後に吸気弁3が閉位置HIC、排気弁4が全開位置HE0に保持されるように設定される場合を示し、吸気弁3については、初期化前の半開位置HIMの出力値VIMと初期化後の閉位置HICの出力値VICとに基づいて補正を行ない（図10参照）、排気弁4については、初期化前の半開位置HEMの出力値VEMと初期化後の全開位置HE0の出力値VE0とに基づいて補正を行なう（図11参照）。具体的には、吸気弁3の半開位置HIMの出力値VIMと閉位置HICの出力値VICとを直線で結ぶ補正を行なって全開位置相当の2（ $HIM - HIC$ ）に対応する出力値を $[VIC + 2(VIM - VIC)]$ と推定し、同様に排気弁4の半開位置HEMの出力値VEMと全開位置HE0の出力値VE0とを直線で結ぶ補正を行なって閉位置相当のHE0-2（ $HE0 - HIM$ ）に対応する出力値を $[VE0 - 2(VE0 - VIM)]$ と推定する。

【0036】このようにすれば、第1の実施の形態と同様、通常の初期化の設定における位置センサ51の出力値を用いて簡易に補正を行なえる。精度については、同一の弁における同一の位置センサ51の2つの出力値を用いることによっては向上するが、初期化後の開閉位置とは異なる開閉位置における出力値については、推定値であるのでやや低下する可能性がある。

【0037】なお、吸気弁3と排気弁4の初期化後の開閉位置を上記実施の形態とは反対に設定しても同様に実行できる。次に、第4の実施の形態について説明する。

【0038】この実施の形態では、吸気弁3及び排気弁4について、それぞれエンジンの運転停止時に、初期化後の開閉位置とは異なる開閉位置に一時的に保持させ、この開閉位置に対応する位置センサ51の出力値をメモリに記憶しておく。そして、吸気弁3及び排気弁4について、それぞれ始動前の初期化後における出力値と、前回運転停止時に記憶された出力値とに基づいて位置センサ51の補正を行なう。

【0039】図12は、エンジン運転停止時に一時的に吸気弁3を全開位置HIOE、排気弁4を閉位置HECEに保持し、初期化後は吸気弁3を閉位置HICS、排気弁4を全開位置HEOSに保持するようにした場合を示す。

【0040】吸気弁3については、運転停止時の全開位置HIOEの出力値VIOEと、初期化後の閉位置HICSの出力値VICSとに基づいて補正を行ない（図13参照）、排気弁4については、運転停止時の閉位置HECEの出力値VECEと、初期化後の全開位置HEOSの出力値VEOSとに基づいて補正を行なう（図14参照）このようにすれば、同一の弁の全開位置に対応する出力値と閉位置に対応する出力値とを用いることで、より高精度な位置センサ51の補正を行なうことができる。

【0041】なお、吸気弁3と排気弁4のエンジン運転停止時と初期化後の開閉位置を上記とは反対に設定しても、同様に実行できる。しかし、エンジン運転停止時と始動時とでは、一般的に温度差があり、温度差があると

位置センサ51の出力値が変化する。

【0042】そこで、第5の実施の形態では、前記エンジン運転停止時と始動時との温度差の補正を行なう。第4の実施の形態と同様にエンジン運転停止時に一時的に吸気弁3を全開位置HIOE、排気弁4を閉位置HECEに保持し、初期化後は吸気弁3を閉位置HICS、排気弁4を全開位置HEOSに保持するようにした場合について説明する。

【0043】エンジン運転停止時に前記水温センサ11によって検出される水温 $T_{wE}$ を記憶しておき、始動時に検出された水温 $T_{wS}$ との温度差 $\Delta T_w (=T_{wS}-T_{wE})$ を算出する。

【0044】そして、エンジン運転停止時の吸気弁3の全開位置HIOEに対応する位置センサ51の出力値 $V_{IOE}$ を、前記温度差 $\Delta T_w$ に応じた補正分 $\Delta V_{IOS}$ で補正し、該補正された出力値 $(V_{IOE}-\Delta V_{IOS})$ と始動時初期化後の閉位置HICSに対応する出力値 $V_{ICS}$ とに基づいて、前記同様の直線補間等により補正する(図15参照)。

【0045】同様に、エンジン運転停止時の排気弁4の閉位置HECEに対応する出力値 $V_{ECE}$ を、前記温度差 $\Delta T_w$ に応じた補正分 $\Delta V_{ECS}$ で補正し、該補正された出力値 $(V_{ECE}-\Delta V_{ECS})$ と始動時初期化後の排気弁4を全開位置HEOSとに基づいて、直線補間等により補正する(図16参照)。

【0046】このように温度差の出力値補正を行なった上で位置センサ51の出力値とアーマチャ42位置の検出値との関係を補正することにより、より精度よく補正することができる。

【0047】なお、図1に一点鎖線で示すように、弁駆動装置2に油温センサ17を設け、該油温センサ17によって検出される吸・排気弁の弁体摺動部近傍の潤滑油温度を用いて、前記温度差補正を行なってもよく、より高精度な温度差補正を行なえる。

【図面の簡単な説明】

【図1】実施の形態におけるエンジンのシステム構成図。

【図2】実施の形態における電磁動弁装置の吸・排気弁閉弁状態時の構成を示す断面図。

【図3】同上電磁動弁装置の吸気弁半開状態時の構成を示す断面図。

【図4】吸・排気弁の共振初期化制御の様子を示すタイ

ムチャート。

【図5】第1の実施の形態における吸気弁と排気弁を異なる開閉位置に共振初期化したときのアーマチャ変位の様子を示すタイムチャート。

【図6】同上実施の形態における位置センサの補正の様子を示す図。

【図7】第2の実施の形態における吸気弁同士と排気弁同士を気筒間で異なる開閉位置に共振初期化したときのアーマチャ変位の様子を示すタイムチャート。

【図8】同上実施の形態における位置センサの補正の様子を示す図。

【図9】第3の実施の形態における吸気弁と排気弁の初期化前と、異なる開閉位置に共振初期化したときと、のアーマチャ変位の様子を示すタイムチャート。

【図10】同上実施の形態における吸気弁側の位置センサの補正の様子を示す図。

【図11】同上実施の形態における排気弁側の位置センサの補正の様子を示す図。

【図12】第4の実施の形態における吸気弁と排気弁のエンジン運転停止時と、異なる開閉位置に共振初期化したときと、のアーマチャ変位の様子を示すタイムチャート。

【図13】同上実施の形態における吸気弁側の位置センサの補正の様子を示す図。

【図14】同上実施の形態における排気弁側の位置センサの補正の様子を示す図。

【図15】第5の実施の形態における吸気弁側の位置センサの補正の様子を示す図。

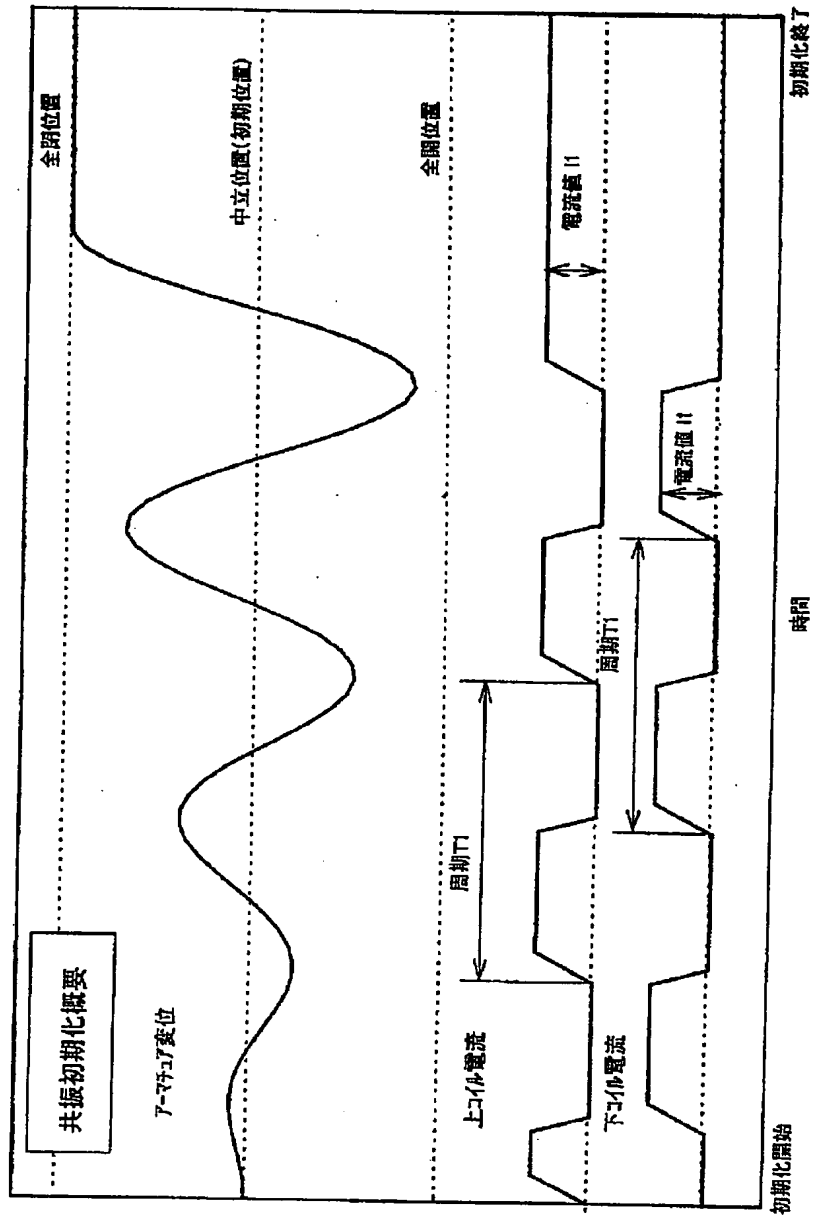
【図16】同上実施の形態における排気弁側の位置センサの補正の様子を示す図。

【符号の説明】

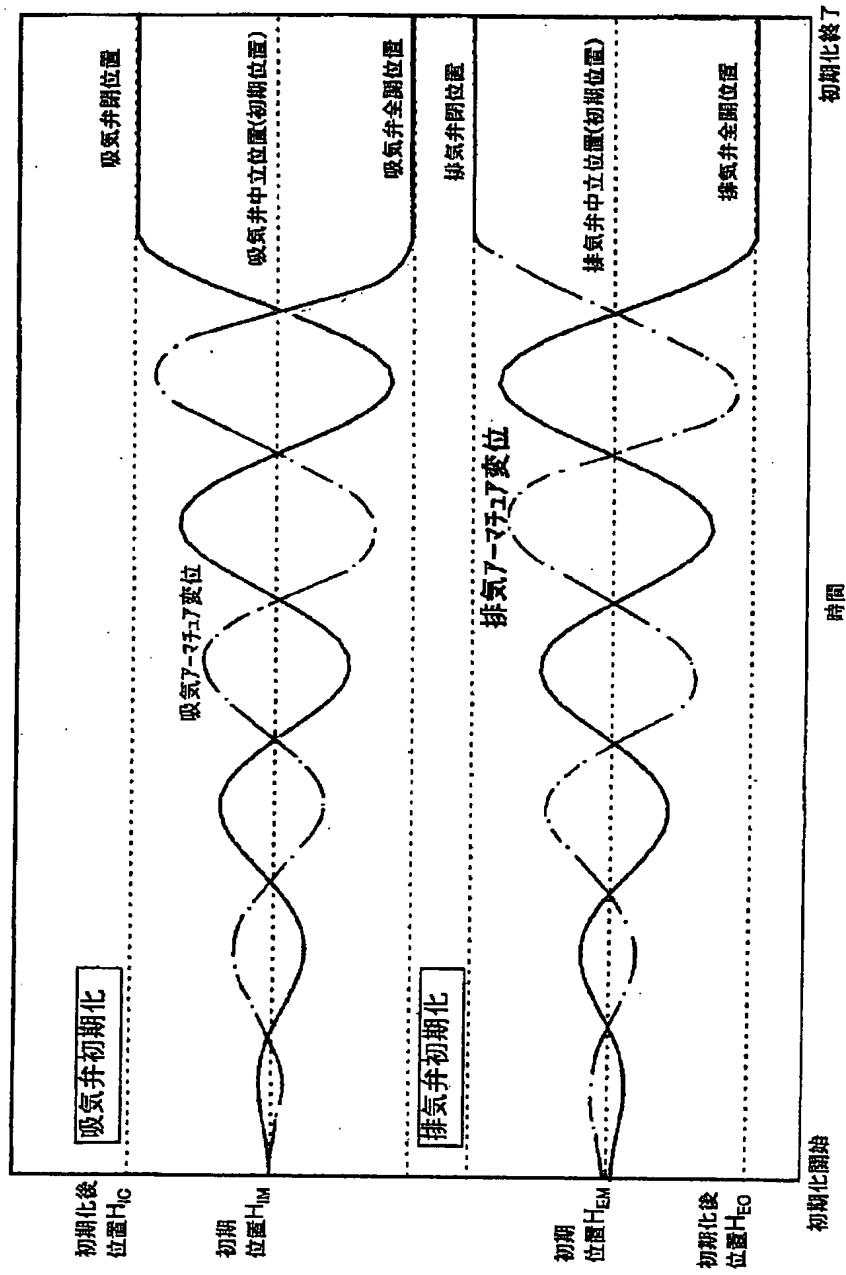
- |    |            |
|----|------------|
| 1  | エンジン       |
| 2  | 弁駆動装置      |
| 3  | 吸気弁        |
| 4  | 排気弁        |
| 10 | クランク角センサ   |
| 11 | コントロールユニット |
| 33 | 閉弁用スプリング   |
| 42 | アーマチャ      |
| 43 | 閉弁用電磁石     |
| 44 | 開弁用電磁石     |
| 45 | 開弁用スプリング   |

[illegible]

【図4】

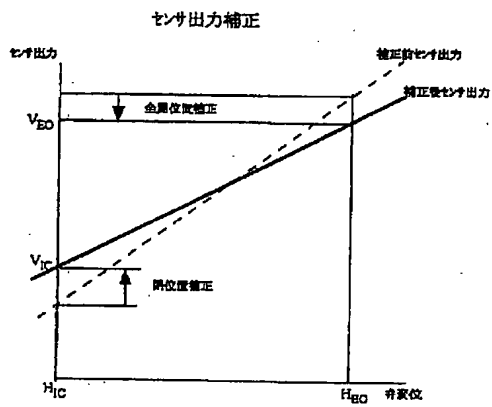


【図5】

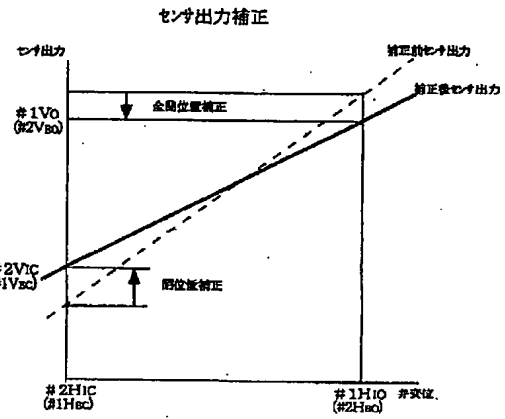




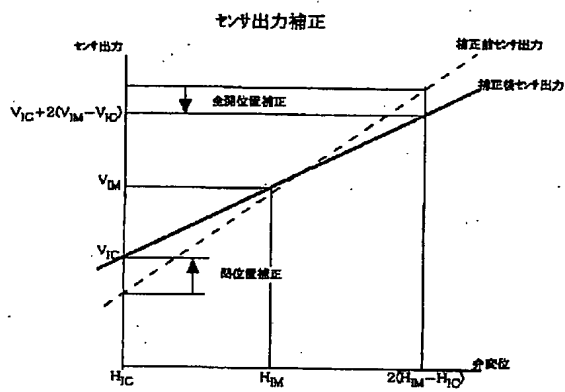
【図6】



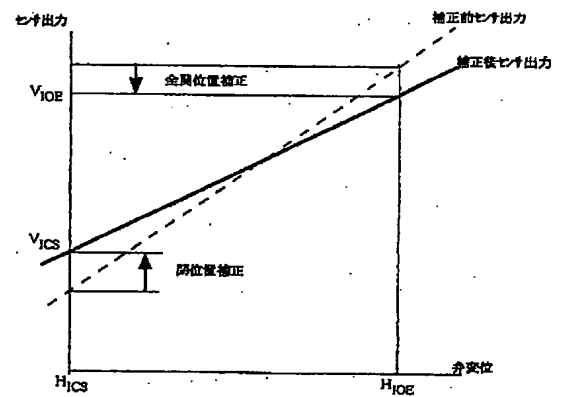
【図8】



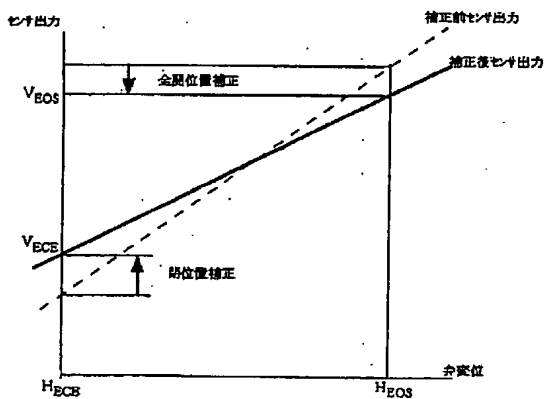
【図10】



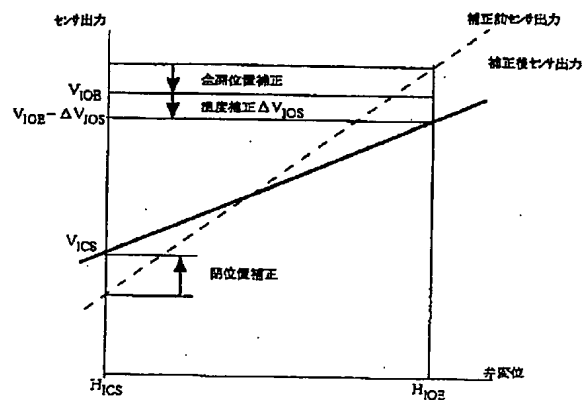
【図13】



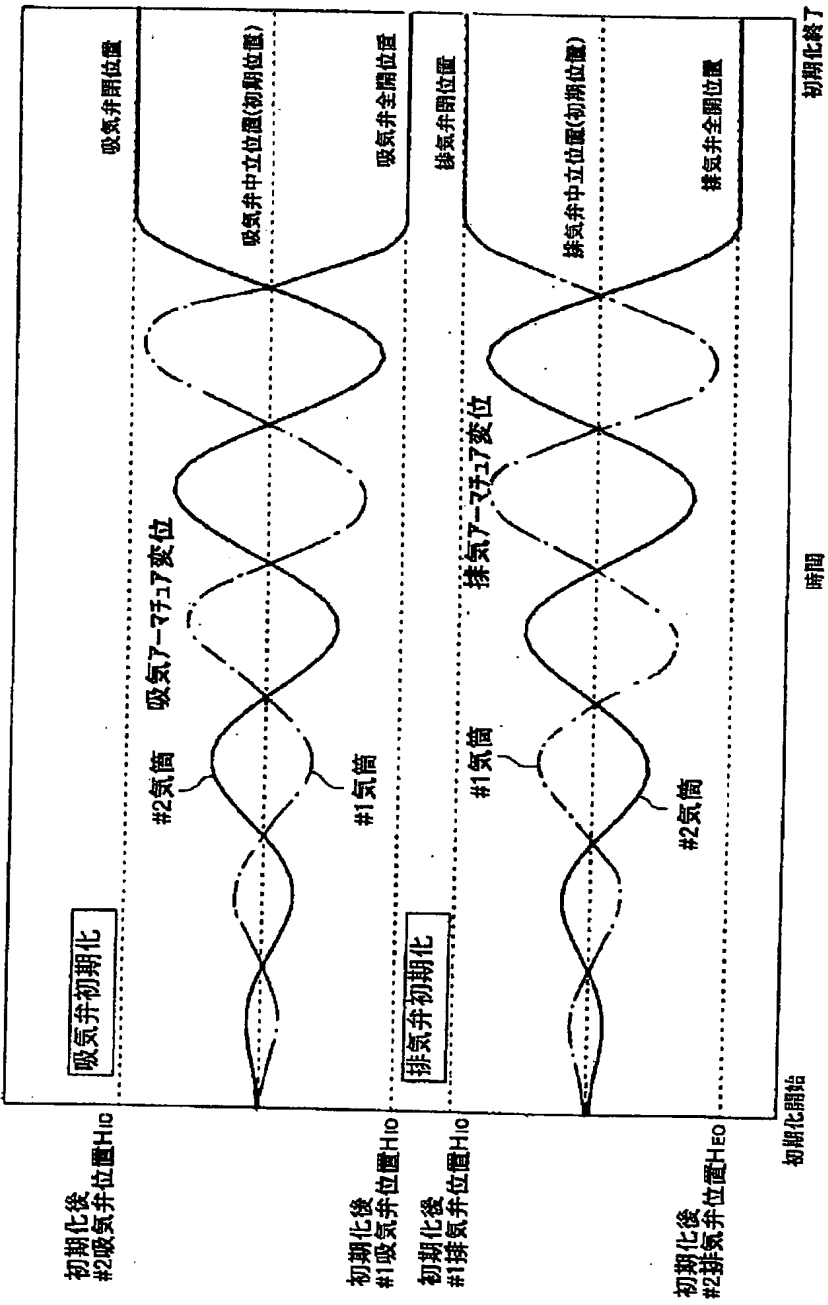
【図14】



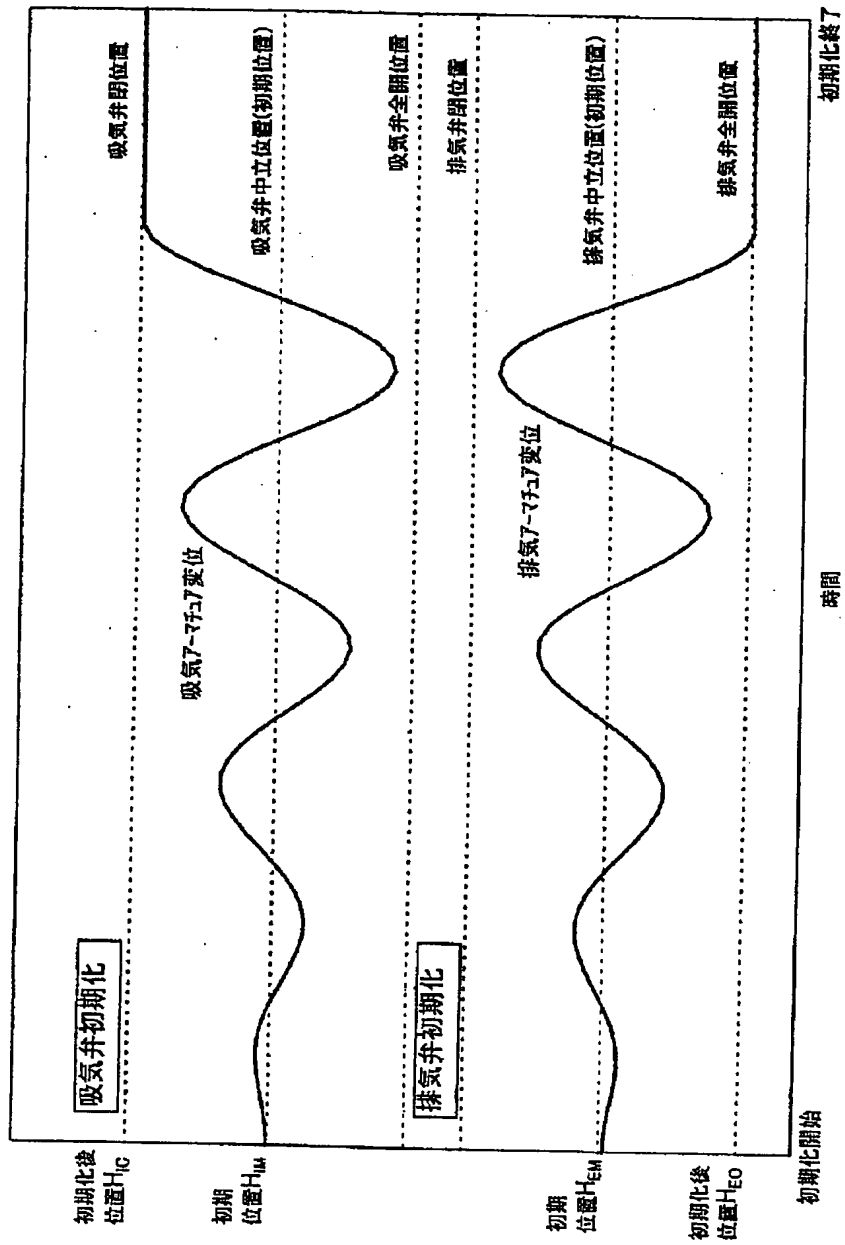
【図15】



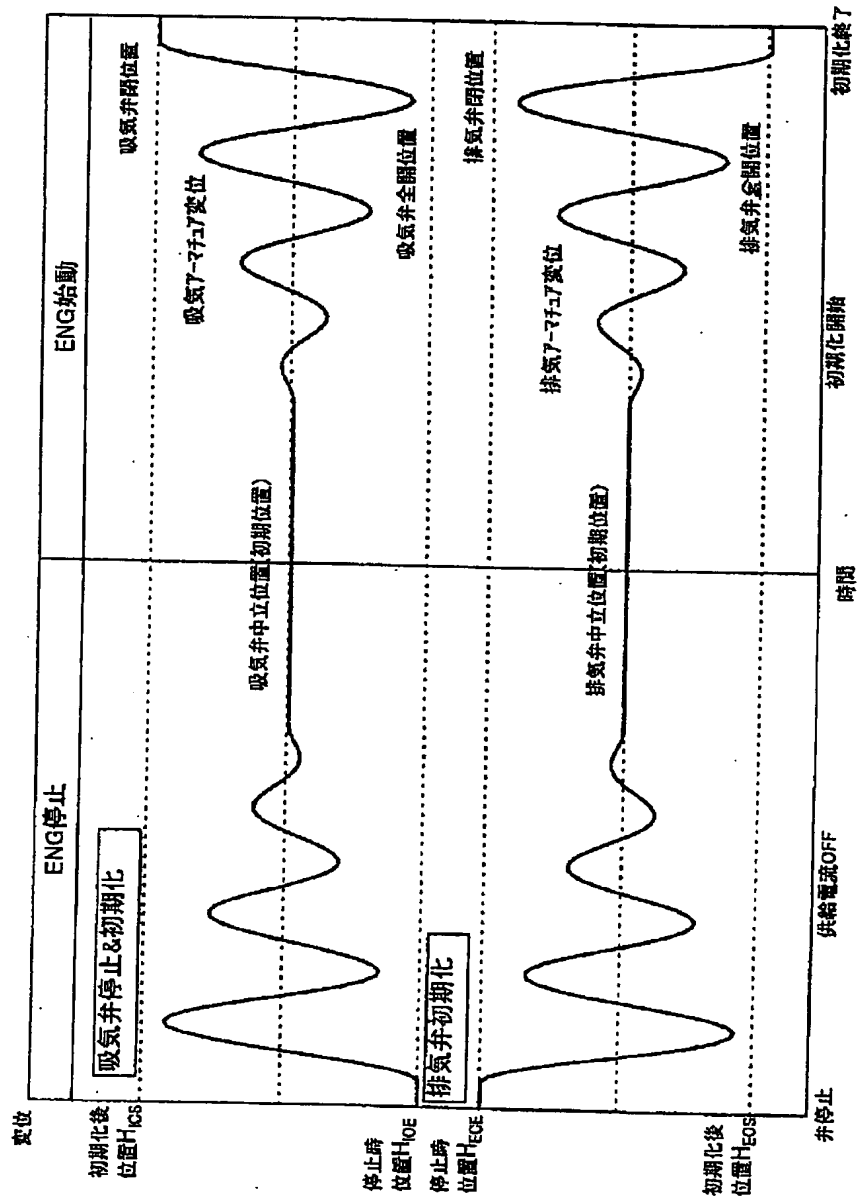
【図7】



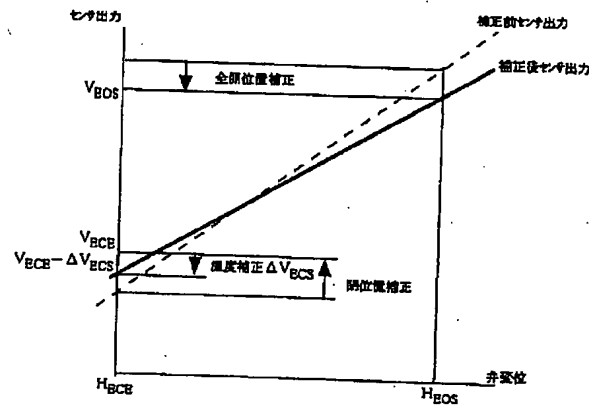
【図9】



【図12】



【図16】



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